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A Deep Learning Based Arrhythmia Detection in Iot Wearable Healthcare System

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ABSTRACT: *The development of internet of things (IoT) technology linked with the healthcare industry and the recent growth in health wearable devices have allowed researchers to investigate in developing continuous monitoring systems to continuously analyze the enormous electrocardiogram (ECG) signals to detect and classify cardiac abnormalities and arrhythmia. However, researches often ignore the importance of recognizing arrhythmia in a timely manner to prevent and avoid any sudden and unexpected deaths of the subject. Thus, a high classification accuracy of the minority classes of ECG signals is extremely important for diagnosing arrhythmia. The heart's operation is deemed to have long periods of normal activity and short periods of arrhythmic activity. So, achieving high accuracy is quite easy. Nevertheless, the difficulty relies in achieving high performance on other metrics such as F1 score, precision and recall, identifying the small cardiac abnormalities, the S and V beats. In this project, a continuous ECG monitoring system tailored for athletes is proposed, the incentive is to analyze the collected data by the sensors at a Fog layer between the devices and the cloud layers of the proposed system architecture, where effective decisions can be taken immediately once something serious occur. To detect and classify arrhythmia; we propose an ECG arrhythmia classification system based on deep learning algorithms that comprises two major steps: 1) a deep learning model to classify the ECG signals into two different main beats, normal and abnormal; 2) a transfer learning algorithm is proposed to further classify the S and V beats in order to enhance their accuracy.*
Keywords: ECG,IOT*.*

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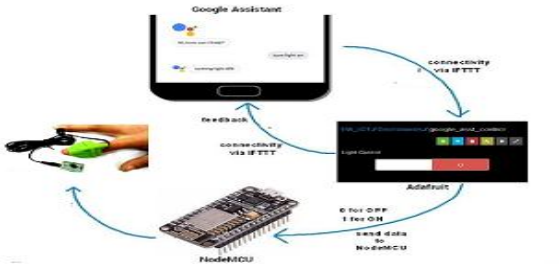
I. INTRODUCTION:

People's lives have been changed dramatically due to tech- nological advancement in smart and diverse types of consumer electronics. These devices, known as the Internet of Things (IoT), are connected by advanced communication technolo- gies to the Internet to exchange information People's lives have been changed dramatically due to tech- nological advancement in smart and diverse types of consumer electronics. These devices, known as the Internet of Things (IoT), are connected by advanced communication technolo- gies to the Internet to exchange information People's lives have been changed dramatically due to tech- nological advancement in smart and diverse types of consumer electronics. These devices, known as the Internet of Things (IoT), are connected by advanced communication technolo- gies to the Internet to exchange information

A technique used in artificial intelligence (AI) called deep learning teaches computers to interpret data in a manner modeled after the human brain. Deep learning models can identify intricate patterns in images, text, audio, and other types of data to generate precise analyses and forecasts.

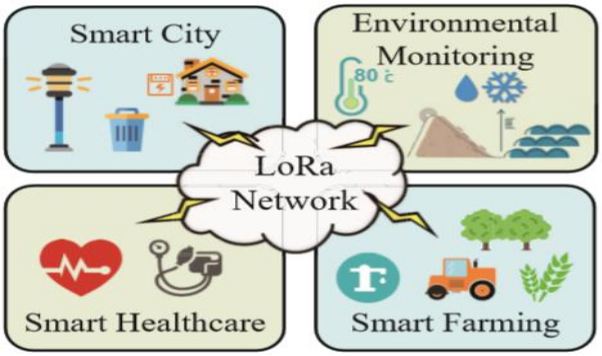
II. SENSING STATION

Any physiological parameter, including blood pressure, glucose levels, and blood oxygen saturation, can be measured. Low power microcontrollers are directly connected to the sensors. The Wi-Fi module was then linked to these microcontrollers. When a human parameter changes, the sensor will detect the change and give an analog signal in response. If the server is close enough to the sensor's Wi-Fi range, the microcontroller, which has an internal ADC, will convert the analog signal from the sensor to an equivalent digital value and calibrate it to its unit scale.



III. LONG RANGE (LORA) NETWORK

LoRa allows for communication over long distances; in densely populated regions, it can provide up to 4.8km of range, while in rural areas, the range can occasionally reach 16km! Low Power Consumption: LoRa devices consume little power, leading in longer battery life for IoT devices. LoRa WAN is suggested by the LoRa Alliance, which defines the network protocol at the MAC and network levels. A whole LoRa network is made up of various components.

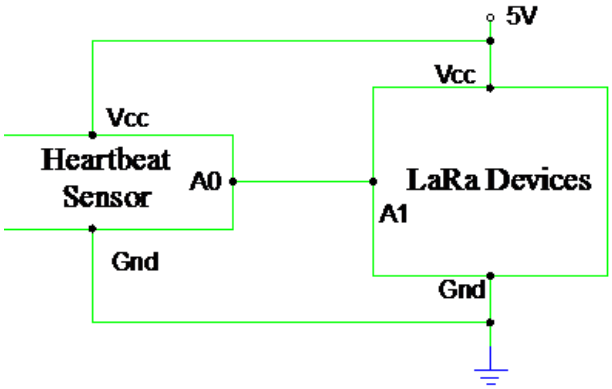


➢ **LoRa module:**

LoRa stands for Long Range Radio and is primarily intended for M2M and IoT networks. This technology will allow public or multi-tenant networks to connect many applications running on the same network.

➢ **LM35 Sensor Interface:**

LM35 is an analog, linear temperature sensor whose output voltage varies linearly with change in temperature.Â LM35 is three terminal linear temperature sensor from National semiconductors. It can measure temperature from-55 degree celsius to +150 degree celsius. The voltage output of the LM35 increases 10mV per degree Celsius rise in temperature.



➢ **Adafruit IO:**

Adafruit IO is an IOT platform built around the Message Queue Telemetry Transport (MQTT) Protocol. MQTT is a lightweight protocol that allows multiple devices to connect to a shared server, called the MQTT Broker, and subscribe or write to user defined topics.

➢ **GOOGLE Assistant Through IFTTT:**

The programming conditional expression "if this, then that" is whence FTTT gets its name. What the company offers is a software platform that links products from various developers in order to start one or more automations involving those products.

- **Heartbeat sensor interface with LaRa:**

For Lara compatible devices, Pulse Sensor Amped is a plug-and-play heart-rate sensor. Students, artists, athletes, makers, game developers, and mobile app developers can all use it to quickly incorporate real-time heart rate data into their works. Hardware amplification and noise cancellation are added by Pulse Sensor. Obtaining accurate pulse readings is substantially quicker and simpler. It is possible to use a 3V or 5V Lara Device with Pulse Sensor Amped.

- **EMI filtering:**

The input side also has low pass filtering to reduce noise being imported into the regulator from the vehicle supply. The same filtering reduces switching noise being exported from the regulator into the vehicle supply to minimise the possibility of interference with other vehicular equipment. The filtering is also designed to ensure the stability of the input to the regulator at all input voltages.

IV. CONCLUSION

IoT technology provide solutions for issues in many industries, including the health sector. In this way, the remote monitoring system for cardiac signals proposed in this work enables remote supervision and offers a support tool in the timely detection of issues related to arrhythmias such as ventricular, supraventricular, and fusion beats and enhances patient care. When using IoT technology to solve challenges that call for remote supervision of a specific variable, architectural choices made in this work are helpful. For instance, having distinct components enables the use of various technologies and the division of labor in accordance with the requirements of each component. This strategy aids in the system's decoupling, scalability, and maintenance. As a result of the flexibility it offers in the data format, a nonrelational database offers a straightforward method to store data like JSON. Additionally, API REST makes database management simpler by offering CRUD functions rather than requiring database clients in each component. This means that any adjustments to the database that are necessary only affect the data management component. The classification of supraventricular, ventricular, and fusion beat arrhythmias, however, clearly shows that the KNN approach outperforms convolutional neural networks and the random forest.

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